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and 2 new varieties of Philippine ferns.—E. B. COPELAND (*idem* 277-284) describes 8 new species and 3 new varieties of ferns from China; and the same author (*idem* 285-300) presents *A revision of the Philippine species of Athyrium* in which 46 species are recognized, 5 species and 1 variety being described as new to science.—E. D. MERRILL (*idem* 307-315), under the title of *Philippine Freycinetia*, records 24 species of this genus from the Philippine Islands, 8 being described as new; and the same author (*idem* 317-338) has published 6 new species of oaks and 6 new species and 1 new variety of the genus *Radermachera* from the Philippine Islands.—R. WAGNER (Oesterr. Bot. Zeits. 58:435-439. 1908) has described a new species of *Tropaeolum* from Columbia.—F. SENNEN (Bull. Acad. Intern. Geogr. Bot. III. 17:449-480. 1908), under the title of *Plantes d'Espagne*, has published in joint authorship with C. PAU 6 new species and several new varieties of flowering plants from Spain.—R. FRIES (K. Sv. Vet. Akad. Handl. 42:1-67. pls. 1-7. 1908) has published 23 new species and 14 new varieties of Malvales, chiefly from South America; the same author (*idem* 43:1-114. pls. 1-10. 1908) recognizes 37 species for the genus *Wissadula*, of which 11 species and 4 varieties are described as new, and a new genus (*Pseudoabutilon*) of the Malvaceae is proposed, to which are referred 9 species, 3 being new to science.—K. JOHANSSON (Arkiv för Botanik 7:no. 12, pp. 48. pls. 1-5. 1908), under the title *Hieracia vulgata Fr. från Torne Lappmark*, enumerates 35 species, 20 of which and 3 varieties are described as new.—J. M. GREENMAN.

Effect of light on germination of seeds.—HEINRICHER¹⁴ has recently added two more papers to his series on the effect of light on germination, and KINZEL¹⁵ publishes a second paper (preliminary statement) on his extensive researches on this subject. Data enough are now at hand to get at some general principles. In respect to the effect of white light upon their germination, seeds may be divided into four groups: those requiring light for germination (*Rhododendron javanicum*, *R. hirsutum*, *R. ferrugineum*, *Drosera capensis*, etc.); those germinating more quickly and fully in light (*Veronica peregrina*, *Allium suaveolens*, etc.); those germinating equally well in light and darkness (*Myrmecodia echinata*, etc.); and those retarded in germination by light (*Phacelia tanacetifolia*, *Pedicularis Sceptrum Carolinum*). It is agreed by both authors that the favorable effect of light is not due to its causing an early carbon assimilation, but rather to its effect upon enzyme activity on production and therefore upon the digestion of stored foods. The conclusion concerning photosynthesis seems to be justified, for in all cases tested the light is as effective in CO₂-free chambers as in chambers containing CO₂. The effects of different rays as stated in the following paragraph also seem

¹⁴ HEINRICHER, E., (1) Beeinflussung der Samenkeimung durch das Licht. Wiesner-Festschrift. Wien. 1908. (2) Die Samenkeimung und das Licht. Ber. Deutsch. Bot. Gesells. 26a:298-301. 1908.

¹⁵ KINZEL, W., Die Wirkung des Lichtes auf die Keimung. Ber. Deutsch. Bot. Gesells. 26a:105-115. figs. 4. 1908.

to support this conclusion. I see no grounds, however, for concluding that the effect is upon the digestive enzymes rather than upon some other mechanism of the protoplasm.

KINZEL's attention has been largely centered upon the effects of rays of different refrangibility. HEINRICHER¹⁶ early found that the red end of the spectrum was most effective in *Veronica peregrina*. KINZEL's results indicate that this is generally the case. Among different species, however, there is a great variation in the relative effectiveness of various rays. Green is by far the most effective with *Nicotiana*, while with *Veronica* yellow gives the greatest stimulation. KINZEL finds the blue rays least effective; in fact they often cause marked retardation. In many cases of seeds favored in germination by light, blue gave a much slower and lower percentage of germination than darkness. KINZEL comments upon the general retarding effect of blue light, while HEINRICHER later points out that in the seeds of *Phacelia tanacetifolia* which are retarded in germination by white light, blue markedly stimulates germination.

Many of the "light-loving" seeds demand a considerable period of rest after harvest, during which they become thoroughly dried out. In *Veronica bellidioides* three and one-half months was the most effective period. In the short-lived seeds of *Drosera* fifteen hours of drying in the laboratory best effected their "after-ripening." HEINRICHER says, "On the whole the experiments indicate that the results in the germination of such seeds as are helped by light depends upon the age of the seed, upon the quickness of drying after harvest, further, also, upon whether this takes place in light or darkness, and, if in the first way, whether in one layer or several. Finally, even the moisture content of the air during storage must be considered as a factor. It is evident that the conditions are extraordinarily complex and that conformity of results is to be expected only under the consideration of all these factors."

HEINRICHER believes that the similarity in behavior of various seeds toward light is more often connected with their phyletic relationships than with likeness of ecological habit.

It seems to the reviewer that in cases where evident coats appear, the investigators should work with coat-free seeds to make sure that the coats by partial exclusion of oxygen, salts, or even water are not hindering germination. In such cases light may be a means of compensating some other limiting condition of germination. It is also evident, from the variable results, that the real solution of the problem will come from learning the particular dormant process in each case that is aroused by light. This ought to be possible in view of the great advance being made in our knowledge of the catalytic nature of protoplasmic activity, but it will demand an attack on the problem from other points than the mere effects of light upon the living seeds.—WM. CROCKER.

¹⁶ HEINRICHER, E., Ein Fall beschleunigendes Wirkung. Ber. Deutsch. Bot. Gesells. 17:308-311. 1899.